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North-Central Section - 54th Annual Meeting - 2020

Paper No. 16-22

Presentation Time: 8:30 AM-5:30 PM

PRE-ERUPTIVE TEMPERATURES AND ERUPTION DYNAMICS OF RHYOLITE LAVA, NIMBIN RHYOLITE DOME COMPLEX, EASTERN AUSTRALIA

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The Nimbin Rhyolite is a complex of coalescing rhyolite lava domes and flows erupted on the flanks of the early Miocene, Tweed shield volcano, in eastern Australia. The rhyolite dome complex covers an area of roughly 400 km² and reaches a maximum thickness of about 500 m. Individual lavas are up to 100 m thick and consist of either crystal-poor (<5 vol. %) or crystal-rich (10-30 vol. %) flow-banded rhyolite units that occupy somewhat distinct parts of the dome field. Both petrographic types contain similar phenocryst assemblages dominated by subequal quartz and sanidine, plagioclase, orthopyroxene, and minor to trace clinopyroxene and ilmenite. To evaluate pre-eruptive conditions for the crystal-rich and crystal-poor endmembers, we calculated crystallization temperatures using the two-feldspar and two-pyroxene formulations described by Putirka (2008). While we have no independent evidence to accurately define pressure, we can examine relative temperatures derived for phenocryst core and rim compositions in the same sample, as well as coexisting micro-phenocryst and groundmass phases. We find no systematic compositional variation between cores and rims for feldspar and pyroxene phenocrysts in both rhyolite petrographic types. In contrast, groundmass feldspars and pyroxenes in crystal-poor rhyolite yield mean temperatures that are ~100°C higher than their respective phenocrysts. The apparent late-stage increase in pre-eruptive temperature is consistent with thermal rejuvenation of a near-solidus upper-crustal magma body. The thermal input was likely supplied by mafic magma, as rhyolite lavas and pyroclastic units of the Tweed volcano commonly contain intercalated basaltic lavas. A reduction in viscosity attendant with an increase in temperature immediately prior to eruption may help explain the emplacement of highly degassed rhyolite lavas that extends up to 5 km from individual vents, without appealing to anomalously high eruption rates.

Putirka, Keith P., 2008, Thermometers and barometers for Volcanic Systems, *Reviews in Mineralogy & Geochemistry*, 69: 61-120.

Session No. 16--Booth# 71

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Monday, 18 May 2020: 8:30 AM-5:30 PM

Lake Superior Ballroom KJ (Duluth Entertainment Convention Center)

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